Quantifying Co-Benefits/Costs to Mitigation Policies

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Outline

I. Environment
II. Global Interactions
III. Domestic Issues

Note: I and II assume reasonably effective global mitigation.
I. Environment
   A. Less climate change
   B. Other benefits
IGSM Scenarios
(Sokolov et al., 2009, and Webster et al., 2009)
Western Zambezi Frequency Distributions
2050 Decadal Average Surface-Air Temperature Change: Spring

Schlosser et al., 2012
Western Zambezi Frequency Distributions
2050 Decadal Average Precipitation Change: Spring

Schlosser et al., 2012
Multi-sector Modeling Framework

Global change
(temperature, rainfall, world product prices)

Rivers
(runoff, streamflow)

Flooding
(frequency, severity)

Sea level rise
(land loss, salination)

Cyclones
(storm surges)

Energy
(hydropower)

Agriculture
(food, exports)

Infrastructure
(roads, ports, houses)

Economy
(growth, jobs, welfare, inequality)
Mozambique: Roads, Energy, Sea Levels and Cyclones

Change in total value-added (GDP)

- Roads (incl. agriculture)
- Energy
- Sea level rise
- Cyclones

Average deviation from baseline, 2046-2050
Effects of Global Mitigation Policy: Mozambique

Change in total value-added (GDP)

Density

Unconstrained Emissions

L1 Stabilization (with UE prices)

Average deviation from baseline, 2046-2050
Climate Change Impacts for Latin America

• Impacts may be less due to sophistication of the economies.

• Nevertheless, there are real vulnerabilities:
  – Agriculture as an important sector in both GDP and trade,
  – Processing industries dependent on agriculture
  – Hydropower
  – Cyclones
  – Flooding
  – Quality of life (difficult to quantify)

• Reduced climate change impact is a benefit of mitigation.

• Other environmental benefits may arise as a consequence of mitigation (e.g., general air pollution reduction).
II. Global Interactions

A. *World prices for fuels*

B. *Comparative advantage*

C. *Trade and the second best*

D. Shocks and energy security

E. Regional trade

F. Technology

G. Investment
World Oil Producer Prices
(Unconstrained emissions versus L1S)
World Agricultural Price Index
(Unconstrained emissions versus L1S)
Effects of Global Mitigation Policy: Mozambique

Change in total value-added (GDP)
Effects of Global Mitigation Policy: Zambia

Change in total value-added (GDP)

GDPfcX Impacts Relative to XW from UE

Ratio

Density

ue zall2
Pue zall2
RPue zall2
Effects of Global Mitigation Policy: Malawi

Change in total value-added (GDP)
Comparative Advantage

• Hypothesis: Latin America and Africa are better endowed with renewable energy potential than many parts of Asia, Europe and North Africa.

• Global CGE models likely fail to capture this due to:
  – Relatively crude renewable energy technology representations
  – Aggregation

• What if hypothesis is true?
Trade and the Second Best

• Carbon intensity
• Dealing with the border
• Footloose industry

Measuring carbon intensity

*Methods and data*

• Capture direct and indirect carbon use
  – Direct use of fuels (i.e., crude oil, natural gas and coal) and transformed energy (e.g., electricity and petroleum)
  – Indirect use of carbon embodied in other inputs (e.g., plastics)

• Multiplier analysis using supply-use tables
  – Carbon enters the system as fossil fuels
  – Track all upstream and downstream product flows to determine total (net) carbon use per unit of output or final demand

• 2005 supply-use and energy balance tables
  – 172 industries, 105 products and 6 household income groups
Measuring carbon intensity

*Carbon embodied in products*

- Energy sectors are the most carbon intensive:
  - Primary fuels: Coal (12.3), Gas (2.1) and Crude oil (1.0)
  - Transformed energy: Electricity (3.2) and petroleum (0.67)

- Margins account for 7% of carbon within products
Measuring carbon intensity

Exports

• RSA is a large net exporter of carbon (2.5x imports)
  – Large export intensive sectors are typically carbon-intensive
Measuring carbon intensity

Employment

• Carbon-intensive products tend to be:
  – Less labor-intensive
  – Less important for overall employment
Measuring carbon intensity

Consumers or households (1)

- Household emissions < national average, but unevenly distributed
  - Poorest 20% = 0.3 tons of CO2 pc (≈ Benin)
  - Richest 4% = 37.8 tons of CO2 pc (≈ Kuwait)
What about trade?

• Border tax adjustments (for trade with countries with no emissions policies)
  – Calculate carbon content of imports and exports
  – Tax imports and rebate exports
  – Similar to VAT

• BTAs are strangely controversial
  – Energy Model Forum project
  – WTO legality

• Coping with the border is important
  – Political sensitivity
  – Footloose industry (NAFTA, Vietnam accession to WTO etc.)
Global Interactions (mentions)

• Fuel price shocks
  – Strong impacts for import dependent economies

• Regional trade and renewables
  – Portfolio affect across sources
  – Use of hydropower as storage

• Technology
  – Diffusion is potentially a huge co-benefit
  – Transformative technologies

• Investment
  – Vintage capital
III. Domestic Issues
   A. Public finance
   B. Employment
   C. Taxation and factor prices
   D. Poverty and inequality
   E. Imperfect competition
Public Finance and Carbon Taxes

• Revenue neutrality
  – Replace other indirect taxes
  – Replace direct taxes

• Revenue increase
  – Increase government services
  – Increase transfers (negative direct tax)
  – Increase government savings
Unemployment

Some conception that allows for $L_s > L_d$, where the wage plays a key role in employment.
Taxation and Factor Prices

GDP = GDPfc + Indirect Taxes or
C+I+G+(X-M) = Sum(j, w(j)*E(j))+IT

Where j is the set of factors, w(j) the factor returns and E(j) endowment stocks.

Suppose dGDP=0 but dIT<0 and economy is at full employment (trade liberalization in an endowment economy). What happens to factor prices?

Drawn from: A Note On Taxes, Prices, Wages, And Welfare In General Equilibrium Models, by Sherman Robinson and Karen Thierfelder
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References
working papers available at

www.wider.unu.edu

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